

Simulations of Resonant Intraband and Interband Tunneling Spin Filters

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Recent theoretical studies suggest the possibility of polarizing electron spins by resonant tunneling [1], and obtaining spin-polarized current in resonant tunneling heterostructures at zero magnetic field [2]. In this work we report our theoretical analysis of spin polarization effects in InAs/GaSb/AlSb resonant tunneling structures. A typical resonant tunneling spin-filtering device structure consists of AlSb double barriers surrounding an asymmetric InAs/GaSb quantum well, where quantized states are spin-split by the Rashba effect. The presence of the type-II broken-gap band offset between InAs and GaSb allows us to fabricate both resonant intraband and resonant interband tunnel structures. We will report on the spin-dependent tunneling properties of both types of structures, and highlight the special properties of resonant interband tunneling which can be used in the design of spin filters.

[1] E. A. de Andrada e Silva and G. C. La Rocca, Phys. Rev. B 59, 15583 (1999).

[2] A. Voskoboynikov, S. S. Lin, C. P. Lee, and O. Tretyak, J. Appl. Phys. 87, 387 (2000).